What is Claimed is

~~CLAIMS~~

1. A polypeptide free of botulinum toxin activity and free of toxoid which induces protective immunity to a type F botulinum toxin.

2. A polypeptide characterized in that it:-
   (a) is free of botulinum toxin activity,
   (b) is free of toxoid, and
   (c) is capable of eliciting, in a mammal, an immunological response that is protective against type F botulinum toxin.

3. A polypeptide according to Claim 1 or 2 comprising a fragment or a derivative of a heavy chain of a type F botulinum neurotoxin.

4. A polypeptide according to Claim 3 wherein said fragment or said derivative is up to 600 amino acids long.

5. A polypeptide according to ~~Claims 3 or 4~~ wherein said fragment is selected from the group consisting of:
   (a) amino acids 848-1278 of a type F botulinum toxin,
   (b) amino acids 848-991 of a type F botulinum toxin,
   (c) amino acids 992-1135 of a type F botulinum toxin, and
   (d) amino acids 1136-1278 of a type F botulinum toxin.

6. A polypeptide according to ~~Claims 3 or 4~~ wherein said derivative comprises a dimer of the fragment according to any of (a)-(d) of Claim 5.

7. A polypeptide composition for use in manufacture of a vaccine, said composition comprising:-

   (1) a polypeptide free of toxin activity and capable of inducing, in a mammal, protective immunity against a botulinum toxin; and

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(2) a polypeptide adapted to facilitate or enhance purification of the composition.

8. A polypeptide composition according to Claim 7 wherein the composition comprises a fusion protein of (1) and (2).

9. A polypeptide composition according to Claim 7 ~~or 8~~ comprising:-

(1) a polypeptide according to ~~any of Claims 1-6~~; and

(2) a polypeptide adapted to bind to a chromatography column.

10. A polypeptide composition according to ~~any of Claims 7-9~~ comprising a polypeptide adapted to bind to ~~an affinity chromatography column~~.

11. A polypeptide according to Claim 8 comprising a fusion protein of:-

(a) amino acids 848 to 1278 of a type F botulinum neurotoxin, with

(b) a purification moiety.

12. A vaccine comprising a pharmaceutically acceptable carrier and a polypeptide according to ~~any of Claims 1-6 or a polypeptide composition according to any of Claims 7-11~~.

13. A recombinant DNA encoding a polypeptide according to ~~any of Claims 1-6 or a polypeptide composition~~ according ~~to any of Claims 7-11~~.

14. A method of producing a polypeptide according to ~~any of Claims 1-6 or a polypeptide composition according to any of Claims 7-11~~ comprising the steps of:-

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(a) expressing in a host cell a DNA encoding a fusion protein, said protein being a fusion of (i) a fragment or derivative of a type F botulinum toxin, and (ii) a moiety adapted to bind to a chromatography column,

(b) obtaining from said host cell an extract comprising the fusion protein, and

(c) purifying the fusion protein using a chromatography column.

15. A method according to Claim 14 wherein the chromatography column is an affinity chromatography column and the fusion protein is removed from the column by elution with a substrate.

16. A method according to Claim 14 ~~or 15~~ further comprising cleaving the fusion protein and retaining the toxin fragment or derivative.

17. A method of making a pharmaceutical composition comprising:-

(a) expressing in a host cell a DNA encoding a fusion protein, said protein being a fusion of (i) a polypeptide free of toxin activity and capable of inducing protective immunity against a botulinum toxin, and (ii) a purification moiety adapted to bind to a chromatography column,

(b) obtaining from said host cell an extract comprising the fusion protein,

(c) purifying the fusion protein using chromatography column, and

(d) incorporating the purified fusion protein into a pharmaceutical composition.

18. A method according to Claim 17 wherein said purification moiety binds to an affinity chromatography column.

19. A pharmaceutical composition comprising:-

(a) a fusion protein, said protein being a fusion of (i) a polypeptide fee of toxin activity and capable of inducing protective immunity against a botulinum toxin, and (ii) a polypeptide adapted to bind to a chromatography column; and

(b) a pharmaceutically acceptable carrier.

20. A pharmaceutical composition according to Claim 19 wherein said fusion protein comprises a polypeptide according to ~~any of Claims 1-8.~~ Claim 2

21. A pharmaceutical composition according to Claim ~~19 or~~ 20 wherein the fusion protein comprises a polypeptide adapted to bind to an affinity chromatography column.

22. A method of vaccinating a mammal against a botulinum toxin, comprising administering to said mammal a vaccine according to Claim 12.

23. A method of vaccinating a mammal against a botulinum toxin, comprising administering to said mammal a pharmaceutical composition according to ~~any of Claims 19-21.~~ Claim 19

Add H14

Add D17